# A REVISION OF THE BORAGINACEAE OF WEST PAKISTAN AND KASHMIR * 

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18. Rochelia Reichenb. Flora 7: 243. 1824; Icon. Crit, 2: 13. t. 123. 1824.

## Raclathris Raf. Sylva Tellur. 167. 1838.

Type species: $R$. saccharata Reichenb.
Usually annual, rarely biennial, villous or hispid herbs. Leaves alternate. Inflorescence terminal, simple or branched, bracteate. Flowers small, blue or white. Calyx usually 5 -fid or rarely $9-10$-fid (not in the West Pakistan or Kashmir species), usually enlarged in fruit, lobes linear, oblong or lanceolate, rounded auricled or sagittate at the base. Corolla small, campanulate, infundibuliform or tubular, tube usually cylindric, throat with or without appendages, lobes small, spreading. Stamens 5, included; anthers ovate, usually obtuse. Gynobase columnar, slightly developed; style filiform, stigma indistinctly capitate. Nutlets 2, 1-seeded, oblong to oblong-ovate, glabrous, smooth to tuberculate, affixed along the whole length of the gynobase.

A genus of about 15 species, centering in southwestern Asia and ranging from central Asia to the Mediterranean basin. One species occurs in Australia.

## Key to the Species

a. Nutlets glabrous, smooth, shining.

1. R. leiocarpa.
a. Nutlets minutely tuberculate to stellate-papillose.
b. Calyx lobes ovate-lanceolate in fruit, auriculate-cordate at base.
b. Calyx lobes ardiosepala. late-cordater anceolate or linear in fruit, never auricu-
c. Calyx strongly -7 mm . long in fruit, erect or slightly recurved at apex, veloped and covered with stiff erect trichomes. 3 , R. macrocalyx
c. Calyx lobes $2-5(-6) \mathrm{mm}$. long in fruit, recurved at apex or throughout their length, not narrowed towards the base, roundish, not unguiculate, midrib poorly developed, trichomes various.
d. Pedicel $10-15 \mathrm{~mm}$, long in fruit, at minimum twice the length of calyx.
d. Pedicel $3-8 \mathrm{~mm}$. long in fruit, at maximum not 4. $R$. peduncularis. calyx.
e. Pedicel in fruit shorter or subequalling the calyx.

[^0]e. Pedicel in fruit always longer than the calyx.
f. Calyx lobes, in fruit, longer to much longer than the nutlets; style exceeding the nutlets by $0.5-1 \mathrm{~mm}$.
6. R. stylaris.
f. Calyx lobes in fruit usually shorter than or equal to, rarely longer than the nutlets; style exceeding the nutlets by 0.5 mm .
g. Calyx lobes linear in fruit, to 0.3 mm . broad, curved, bearing usually straight, sometimes slightly curved, trichomes; nutlets $2-2.5 \mathrm{~mm}$. long, attached subhorizontally.
7. R. bungei.
g. Calyx lobes oblong-lanceolate in fruit, $0.5-0.8 \mathrm{~mm}$. broad, usually erect, sometimes curved, bearing usually uncinate, sometimes curved, trichomes; nutlets $3-3.5$ mm . long, attached vertically or slightly tilted.
8. R. laxa.

1. R. leiocarpa Ledeb. Fl. Alt. 1: 172. 1829; DC. Prodr. 10: 176. 1846;

Boiss. Fl. Orient. 4: 245. 1875; M. Pop. Fl. URSS 19: 557. 1953.
R. incana Kar. \& Kir. Bull. Soc. Nat. Moscou 15: 710. 1841.
R. stellulata var. Kar. \& Kir. loc. cit.
R. lissocarpa Dunn, Kew Bull. 1924: 386. 1924, syn. nov.

Type: Hab. in sterilibus ad fl. Kurtschum deserti Soongaro-Kirghisici orientalis, without citation of collector's name (в).
Icon.: Ledeb. Icon. Pl. Fl. Rossica 3: t. 244. 1847; M. Pop. 1. c. 19: t. 27. fig. 4. 1953.

Annual, erect herb, branched near the base, $5-25 \mathrm{~cm}$. tall. Stem and branches slender, brownish, covered loosely with short, appressed, antrorse, white trichomes. Basal leaves sessile, linear, oblong-ovate or oblongspathulate, entire, obtuse, $10-25 \mathrm{~mm}$. long, $1-2 \mathrm{~mm}$. broad, covered on both surfaces with thin, spreading white trichomes $0.2-0.7 \mathrm{~mm}$. long, arising from large tuberculate bases, lower surfaces sometimes less hairy or rarely subglabrous; cauline leaves gradually decreasing in size upwards. Inflorescence lax, unilateral, short in flower, elongated in fruit, bracteate, bracts lanceolate, acutish. Flowers subsessile, fruits pedicellate, pedicels up to 2.5 mm . long, deflexed. Calyx divided nearly to the base, lobes lanceolate, erect, $1-1.5 \mathrm{~mm}$. long in flower, linear, elongated to 4 mm ., curved their whole length, pubescent in fruit, trichomes straight to slightly curved or sometimes uncinate. Corolla blue, campanulate, slightly narrowed at the throat, tube nearly equal to the calyx, lobes ovate to rotundate, erect or patent, 0.5 mm . long. Nutlets 2 , yellowish- to pinkish-white, glabrous, smooth, shining, 2 mm . long. Style exceeding the nutlets by 0.5 mm .
Distribution: Soongaria, Turkestan, West Pakistan, Kashmir.
West Pakistan: Gilgit Agency: Gurais valley, Minimorg, 3000 m. ., Inayat
25716 (k); Baltistan
the foot of the Masherbrum, hillside near base camp Shahircho, 3650 m ., Webster \& Nasir 5974 (GH, RAW).

Kashmir: Upper Kishenganga Valley: Purane Tilal, R. R. Stewart 4398 (Raw, K-type of $R$. lissocarpa Dunn).

The specimens of Rochelia leiocarpa are usually mixed with those of R. bungei in the collections cited above. Rochelia leiocarpa is very closely related to $R$. bungei from which it can easily be distinguished by its smooth, glabrous, shining nutlets.
2. R. cardiosepala Bunge, Mém. Acad. Sci. St. Pétersb. Savants Étr. 7: 420.1851; Boiss. Fl. Orient. 4 : 246. 1875; C. B. Clarke in Hook. f. Fl. Brit. India 4: 166. 1883; M. Pop. Fl. URSS. 19: 563. 1953; Riedl in Rechinger, Fl. Iranica 48: 90. 1967.
Type: In rupibus graniticis ad Bakali Turkestaniae, Lehmann s.n. (LE). Icon.: M. Pop. 1. c. 19:t. 27. fig. 1. 1953.
Annual, up to 35 cm . tall. Stem and branches covered loosely or densely with antrorsely appressed, short, white trichomes. Basal and lower cauline leaves to 80 mm . long and 7 mm . broad, oblong-ovate to spathulate, entire, sometimes slightly revolute at the margins, obtuse to roundish at apex, gradually attenuated at base into a broad petiole to 50 mm . long; both surfaces covered with spreading, thin, white trichomes, to 1 mm . long, arising from tuberculate bases; upper cauline leaves sessile, obtuse to sometimes acute, gradually decreasing in size upwards. Inflorescence lax, simple or branched, bracteate, bracts leaflike. Pedicels erect, densely hairy, to 2 mm . long in flower, elongated to 4 mm . in fruit, curved, densely pubescent, trichomes usually uncinate. Calyx divided nearly to the base, lobes in flower ca. 2 mm . long and 0.7 mm . broad, lanceolate, much enlarged in fruit, to 6 mm . long and 4.5 mm . broad, acute, erect, auriculate-cordate at base. Corolla pale blue to purple-blue, ca. 3 mm . long, subcylindric, narrowed at the throat, tube usually equalling the calyx, lobes ovate to roundish, suberect to patent. Nutlets 2, grayish-green, to 4 mm . long, stellate-papillose.

Distribution: Iraq, Iran, Afghanistan, West Pakistan, Kashmir, northwest India; Caucasus, Turkestan, Pamir Alaj, Kizil Kum, Syr Darya, Amu Darya, Dsungaro-Tarbagatai, Tien Shan.
West Pakistan: Chitral State: Drosh, 1500 m., Stainton 2277 (bM). Swat State: Jabba Valley, Rechinger 30733a, 30761 (w); between Saidu Sharif and Baherain, about 5 miles from Baherain, Kazmi s.n. (PES). Reported from: GILgit Agency: Astor district, Gudai, R. R. Stewart; Baltistan, Marpu Nullah, Duthie 11839.
Kashmir: Purane Tilal, 2600 m., R. R. \& I. D. Stewart 4448 (к, MICH); Srinagar, 1700 m., R. R. Stewart 12546 (GH).
3. R. macrocalyx Bunge, Mém. Acad. Sci. St. Pétersb. Savants Étr. 7: 419. 1851; Boiss. Fl. Orient. 4: 246. 1875; M. Pop. Fl. URSS 19: 562. 1953; Riedl in Rechinger, Fl. Iranica 48: 92. 1967.
R. rectipes Stocks in Jour. Bot. Hook. 4: 176. 1852; C. B. Clarke in Hook. f. Fl. Brit. India 4: 166. 1883.

Type: In rupestribus granites Turkestaniae ad Balsali, Lehmann s.n. (LE).

Icon.: M. Pop. Fl. URSS 19: t. 27. fig. 3. 1953.
Annual, erect or decumbent herb, up to 15 cm . tall. Stems many, much branched, branches short, both stem and branches usually covered with straight, sometimes curved, thin, spreading trichomes to 1 mm . long, which may arise from conspicuous tuberculate bases on the lower part of the stem. Basal leaves obtuse or roundish, slightly attenuated at base, to 1 cm . long and $1.5-2.5 \mathrm{~mm}$. broad, covered on both sides with trichomes like those of the stems, arising from tuberculate bases; cauline leaves narrower, usually longer than the basal leaves. Inflorescence, lax, fewflowered, bracteate. Pedicels in flower short, in fruit elongated to 7-12 mm ., narrowed towards the base, hairy, trichomes spreading. Calyx divided to the base, lobes lanceolate, acute, $6-7 \mathrm{~mm}$. long, $1.5-2 \mathrm{~mm}$. broad in fruit, narrowed towards the base into a short claw, usually $0.5-1 \mathrm{~mm}$. long, stout, midrib prominent below, covered on both sides with short, erect trichomes (sometimes arising from tuberculate bases). Corolla blue, cylindrical, narrowed at the throat, ca. 1.5 mm . long, lobes short, suberect. Nutlets bluish-white to light brown, ca. 3.5 mm . long, $1.5-2 \mathrm{~mm}$. broad at base, densely stellate-papillose. Style exceeding the nutlets by ca. 1 mm .

Distribution: Iran, Afghanistan, West Pakistan, Kashmir, northwest India, Pamir Alaj, Kizil Kum.
West Pakistan: Kalat State: near Surab, Kazmi $1303 b$ (pes); Rechinger 28329 (w). Quetta Dist.: 5 miles west of Ziarat, Kazmi s.n. (pes); Ziarat proper, $2600 \mathrm{~m} .$, Jafri \& Akbar 2124 (E); Spin Karez, Kazmi $1618 b$ (PES); Rechinger 29213 (w). Reported from: Quetta: Inter Bostan et Saran Tangai, 1800 m., Rechinger 29174 (w); in jugo W. Ziarat in junipereis, 2200 m., Rechinger 29335 (w); Baluchistan, Gurghina, Stocks s.n.

Kashmir: Zaskar, Char, Ichor, 4300 m., Koelz 5663 (GH, MICH, Us); Kargia, Kargah, 4500 m., Koelz 5581 (GH, MICH, US).
4. R. peduncularis Boiss. Diagn. Pl. Orient. 7: 35. 1846; Fl. Orient. 4: 246. 1875; M. Pop. Fl. URSS 19: 561. 1953; Riedl in Rechinger, Fl. Iranica 48 : 91. 1967.
Type: In humidis alpis Kuh Delu, Persiae australis Kotschy 531a (w). Icon.: M. Pop. Fl. URSS 19: t. 27. fig. 2. 1953.
Annual, erect herb, to 20 cm . tall. Stems simple or branched above, covered with short, white, subpatent trichomes. Basal leaves few, sessile, oblong, obtuse or roundish, entire, sometimes slightly revolute at margins, to 2 cm . long and $2-3 \mathrm{~mm}$. broad, both sides covered with, thin, short, spreading white trichomes, usually arising from tuberculate bases; cauline leaves narrower and longer, upper cauline leaves shorter and broader, usually acute. Inflorescence lax, few flowered, bracts minute. Pedicels
$1-3.5 \mathrm{~mm}$. long in flower, patent, gradually narrowed towards the base, elongated to $8-15 \mathrm{~mm}$. in fruit, hairy, trichomes short, erect. Calyx divided nearly to the base, lobes broad, lanceolate, erect, hairy, ca. 2 mm . long, 0.5 mm . in flower, broad, subpatent, the upper half curved, with stout and prominent midrib and patent trichomes $4-6 \mathrm{~mm}$. long, to 1.5 mm . in fruit. Corolla blue, subcylindrical, narrowed at the throat, ca. 2.5 mm . long, tube equalling the calyx, lobes small, ovate to orbicular, suberect. Nutlets 2, white to grayish, ovate, $2-2.5 \mathrm{~mm}$. long, stellate-papillose. Style exceeding the nutlets by about 0.7 mm .

Distribution: Iran, Afghanistan, West Pakistan, Kashmir ?, Pamir Alaj, Tien Shan.

West Pakistan: Chitral State: Lutko, 2550 m., Bowes Lyon 879 (BM). Quetta Dist.: Quetta to Ziarat, at the top of Pass, 2200 m., Kazmi 1660 a (PEs); Lamond 1170 (E); Rechinger 29317 (w); Spin Karez, 1900 m., Kazmi $1632 b$ (PES); Rechinger 29210 (w).
5. R. disperma (L. f.) C. Koch, Linnaea 22: 649. 1849, emend. Karyagin, Isv. Akad. Nauk Azerb. USSR 12: 13, 14. 1945; M. Pop. Fl. URSS 19: 551. 1953; Riedl in Rechinger, Fl. Iranica 48: 94. 1967. Lithospermum dispermum L. f. Descr. Pl. Rar. 13. 1762. Rochelia stellulata Boiss. Fl. Orient. 4: 244. 1875, pro parte non Reichenb. 1824.

Type: "Habitat in Hispania inter Gaditanum et Madritium," without citation of collector's name, Herb. No. 181.11, 181.12 (LINN).

Icon.: L. f.1. c. t. 7. 1762.

Annual, erect or decumbent, to 20 cm . tall. Stem usually branched at the base or sometimes above, branches long, slender; stem and branches covered with short, appressed to subappressed, white trichomes, only those near the base arising from tuberculate bases. Basal leaves ovate to oblongovate, entire, roundish, attenuated towards the base, 5-7 mm. long, 2-3 mm . broad, both sides covered with scattered short, thin, erect, white trichomes; lower cauline leaves linear-lanceolate, obtuse, $12-30 \mathrm{~mm}$. long, $1-3.5 \mathrm{~mm}$. broad; upper cauline leaves gradually decreasing in size, more pubescent. Inflorescence short in flower, later elongated to 15 cm ., bearing distant unilateral fruits; bracteate, bracts small. Pedicels in flower lacking to very short, to 0.5 mm . long, much elongated in fruit, $1.5-2.5 \mathrm{~mm}$. long, always shorter than the calyx, horizontal or recurved, pubescent, trichomes sometimes uncinate. Calyx divided to the base, lobes linear, ca. 1.5 mm . long and 0.2 mm . broad in flower, densely pubescent, erect, to 5 mm . long, curved their whole length or at least the upper half, equalling or longer than the pedicels, densely pubescent with spreading, sometimes uncinate, trichomes in fruit. Corolla blue, subtubular, usually exceeding the calyx, $1.5-1.7 \mathrm{~mm}$. long, lobes small, ovate to rounded, suberect. Nutlets 2, | subhorizontal, white, stellate-papillose. Style exceeding the nutlets by $0.5-1 \mathrm{~mm}$. |
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Distribution: Turkish Armenia, Caucasus, Iraq, Iran, Afghanistan, West Pakistan, Kashmir, Turkestan.

West Pakistan: Kurram Agency: Kurram Valley, Parachinar, Kazmi s.n. (PES); R. R. Stewart 28942, 28955 (RAW); without locality, Harsukh 14747 (k). Quetta Dist.: Spin Karez, 1900 m., Kazmi 1632 (GH, pes); Quetta to Ziarat, at the top of Pass, $2200 \mathrm{~m} .$, Lamond 1172 (E); Ziarat, Jafri \& Akber 2115 (e); Tatli, near Loralai, Nath 6028, 6034 (raw). Shahpur Dist.: Manza Pahl, 16. 4. 1904, Drummond Herb. Kew no. 20432 (e). Waziristan Agency: Wana, Kazmi s.n. (pes); Miram Shah, Kazmi $190 b$ (pes); near Datta Khel, Kazmi $185 b$ (pes). Reported from: South Waziristan: Kaniguram, J. L. Stewart s.n.; Baluchistan, Stocks s.n.; Gilgit Agency: Naltar Valley, R. R. Stewart 26339; Baltistan, Ludlow s.n.

Kashmir: Reported from: Nubra, Herb. Ind. Or. Hook. f. \& Thoms., Thomson s.n.

Closely related to Rochelia disperma is R. bungei from which the former is differentiated by its pedicels always shorter or sometimes subequal to the calyx in fruit, its much longer fruiting calyx lobes (up to 5 mm .) and its subhorizontally attached nutlets. In R. bungei the fruiting pedicels are always longer than the calyx, the calyx lobes in fruit do not exceed 2 mm . in length, and the nutlets are attached horizontally.

Rochelia stellulata Reichenb. in Hook. f. Fl. Brit. India 4: 166. 1883, is a misidentification.
6. R. stylaris Boiss. Fl. Orient. 4: 245. 1875; C. B. Clarke in Hook. f. Fl. Brit. India 4: 166. 1883; Riedl in Rechinger, Fl. Iranica 48: 93. 1967.

Type: Afghanistan: circa Pusht, Griffith s.n. (k-holotype, w-isotype).
Icon.: Riedl in Køie \& Rechinger, Biol. Skr. 13 (4) : fig. 196, 197. 1963.
Annual, usually erect, sometimes decumbent herb, to 15 cm . tall. Stems many, branched, branches long, spreading, stem and branches covered with short, thin, subappressed trichomes. Basal leaves many, petiolate, oblong-spathulate, obtuse to rotundate, entire, gradually narrowed toward the petioles, petiole longer, equal to, or shorter than the lamina, (including petioles) to 35 mm . long and $5(-6) \mathrm{mm}$. broad, both surfaces covered with thin, short, patent, white trichomes arising from prominent tuberculate bases; middle cauline leaves sessile, linear to linear-oblong; upper cauline leaves much shorter and narrower. Inflorescence lax, bearing many unilateral flowers, much elongated in fruit. Pedicels in flower $1-1.5 \mathrm{~mm}$. long, hairy, erect, to 6 mm . long, slender, pubescent, usually recurved in fruit. Calyx divided nearly to the base, lobes lanceolate, $1-1.5 \mathrm{~mm}$. long in flower, nearly equalling the corolla, pubescent, erect, linear, curved inside, especially at the tips, spreading, to 4 mm . long in fruit. Corolla bluishwhite to blue, equal or slightly exceeding the calyx lobes, ca. 2 mm . long, cylindrical, lobes short, suberect. Nutlets 2, grayish, $2-2.5 \mathrm{~mm}$. long, recurved, attached subhorizontally, much shorter than the enlarged calyx, stellate-papillose. Style exceeding the nutlets by $0.5-0.8 \mathrm{~mm}$.

Distribution: Afghanistan, West Pakistan, Kashmir, northwestern India.

West Pakistan: Attock Dist.: Hasan Abdal, R. R. Stewart 6970 (к, Mich); Kazmi s.n. (pes) ; Dickason 69 (mich) ; Aitchison 475 (k). Chitral State: Mastuj track, Barenis, 2000 m., Stainton 2420 (BM); Drosh, Stainton 2277 (bм). Jhelum Dist.: Salt Range, Sone Sihian Valley? (Sayedan Valley), Fleming 29 (e). Khyber Agency: Ali Masjid, Kazmi s.n. (pes); near Landi Kotal, Kazmi 2500 (Pes); Khyber Pass, Torsapper, 1760 m., H. H. Johnston 60 (E); Khyber Pass, H. H. Johnston 13, 44, 45 (E). Dry rocky area near Afghan border, R. J. Rodin 2563 (US). Kurram Agency: south of Parachinar, Kazmi 2506 (Pes). Peshawar Dist.: near Palosi village, Kazmi 2489 (PES); between Peshawar and Pabbi, Kazmi 2525 (PES); Peshawar, J. L. Stewart 137 (GH); Vicary s.n. (with a note) (א); Quetta Dist.: between Yaro and Saranan, on Quetta-Chaman Rd., Kazmi $1490 b$ (pes). Rawalpindi Dist.: Rawalpindi, R. R. Stewart s.n. (к); Rawalpindi, Topi Park, Kazmi 2517 (PES); R. R. Stewart 14587 (GH, US); Margalla, north of Rawalpindi, Pinfold 19 (BM); Dickason 68 (MICH); Harroo, Aitchison 1080 (к); Fattehjung (13-3-1872), Aitchison s.n. (к); Islamabad, rocks at the foot of Paracharian, Kazmi 2537 (pes). Swat State: near Mingora, Kazmi 2478 (pes). Swat Border Post, R. R. Stewart 27420 (RAW); Manglaur, 1000 m., R. R. Stewart $27420 a$ (BM). WAZIRIStan Agency: Miran Shah, Kazmi s.n. (pes). Reported from: Quetta, Suzuka s.n.; Bolan Pass, Rechinger 28425; Kurram Valley, Shalizan, Aitchison 140; Gilgit Agency: Bagrot Valley, Conway s.n.; Nakao s.n.; Hunza State, Russell s.n.

Kashmir: Purig: Parkochin, Koelz 5993B (MICH); Srinagar, R. R. Stewart 11088 (GH); between Kohala and Muzzaffarabad, Kazmi 2518 (pes); Muzzaffarabad, Kazmi 2535 (pes). Miscellaneous: Kashmir, Herb. Ind. Or. Hook. f. \& Thoms., Thomson s.n. (GH); Kashmir (22. 4. 1848), Thomson s.n. (к). Reported from: Gulmarg, R. R. Stewart s.n.; Ladak, Lamayurun, Osmaston 139.
7. R. bungei Trautv. Acta Horti Petrop. 9(2): 462. 1886; M. Pop. Fl. URSS 19: 554. 1953; Riedl in Rechinger, Fl. Iranica 48: 93. 1967.

## Type: Turcomania: Kisil-Arwat, Becker s.n. (Le).

Annual, usually simple, erect, but sometimes sparsely branched and decumbent herbs, $8-20(-30) \mathrm{cm}$. tall. Stem and branches slender, covered on the lower part with patent, on the upper part with subappressed to appressed, thin, white trichomes to 0.7 mm . long. Basal leaves obovate, roundish at apices, entire, attenuated towards the bases, $3-5 \mathrm{~mm}$. long and $1-2 \mathrm{~mm}$. broad, covered on both surfaces with thin, white spreading trichomes, arising from tuberculate bases; middle cauline leaves oblong to linear-lanceolate, acutish, $7-20 \mathrm{~mm}$. long, $1-2 \mathrm{~mm}$. broad; upper cauline leaves shorter and broader. Inflorescence lax, bracteate. Pedicels in flower to 0.7 mm . long, in fruit elongated to 4 mm ., slender, recurved, narrowed and usually twisted at the base, sometimes falling with old fruits. Calyx divided to the base, lobes linear, $1.5-2 \mathrm{~mm}$. long in flower, not much elongated in fruit, linear, shorter than the pedicel, curved inside throughout its length, holding the nutlets, pubescent with short, usually straight, rarely curved, never uncinate trichomes. Corolla blue, tubular, $1.5-2 \mathrm{~mm}$.
long, lobes short, suberect. Nutlets 2, yellowish-white, $2-2.5 \mathrm{~mm}$. long, nearly horizontal, stellate-papillose. Stigma exceeding the nutlets by $0.5-$ 0.7 mm .

Distribution: Iran, Afghanistan, West Pakistan, Kashmir, Turkestan, Pamir Alaj, Kara Kum, Kizil Kum, Syr Darya, Caspian Arals, DsungaroTarbagatai, Tien shan.

West Pakistan: Gilgit Agency: Karakorum range, Baltistan, upper end of Hushe Valley, Chandakore glacier basin at the foot of the Masherbrum, Shahircho, 3600 m ., Webster \& Nasir 5974 (GH-mixed with R. leiocarpa); Dirran, upper branch of Bagrot Valley, Conway 332 (к); Hunza Valley, Zangia Harar, 4000 m., Russell 1068 (BM).

Kashmir: Zanskar, Kargia, 4500 m., Koelz 5582 (GH, MICH, US).
Rochelia incana Kar. \& Kir. sensu Bunge (in Reliq. Lehmann. 243. 1851; Mém. Acad. Sci. St. Pétersb. Savants Etr. 7: 412. 1852; Boiss. Fl. Orient. 4:244. 1875) is a misidentification.

## 8. R. laxa I. M. Johnston, Jour. Arnold Arb. 21: 55. 1940.

Type: Kashmir: Zanskar, Bok, 3450 m., camp ground, Sept. 13, 1931, Walter Koelz $2946 a$ (GH-holotype), $2946 b$ (GH-isotype).

Annual, erect herb to 20 cm . tall with much branched roots. Stem usually branched near the base, branches long, divaricate; stem and branches covered with thin, erect to suberect, white trichomes, on the lower parts usually arising from white tuberculate bases. Basal leaves ovate, obovate or oblanceolate, obtuse to roundish at apices, entire, attenuated towards the bases, $5-20 \mathrm{~mm}$. long, $3-5 \mathrm{~mm}$. broad, both surfaces covered with short, thin, white trichomes arising from white tuberculate bases; middle cauline leaves longer; upper cauline leaves shorter and narrower, covered more densely with comparatively longer, thicker trichomes. Inflorescence lax, unilateral, bracteate, bracts minute, ovatelanceolate. Pedicels in flower lacking to 0.5 mm . long, in fruit to 8 mm . long, narrowed towards the base, covered with spreading, uncinate trichomes. Calyx divided nearly to the base, lobes in flower 1 mm . long, lanceolate, densely pubescent, in fruit oblong-lanceolate, erect to deflexed, $2.5-4 \mathrm{~mm}$. long, $0.5-0.8 \mathrm{~mm}$. broad, usually shorter or sometimes equalling the nutlets, rarely exceeding them by $0.5-1 \mathrm{~mm}$., covered with white, uncinate trichomes, arising from conspicuous tuberculate bases. Corolla blue, ca. 2 mm . long, tubular, tube equalling the calyx, lobes ovate, suberect, 0.5 mm . long. Nutlets 2, white, erect or slightly tilted, tuberculate, $3-3.3 \mathrm{~mm}$. long. Style exceeding the nutlets by $0.2-0.5 \mathrm{~mm}$.

## Distribution: West Pakistan, Kashmir, northwest India.

West Pakistan: Chitral State: Lutko, 2550 m., Bowes Lyon 789 (BM). Gilgit Agency: Baltistan, Marpu Nullah, 3600-4000 m., Duthie 11830 (k); Naltar, 3300 m., R. R. Stewart 26336, 26339 (BM).

Kashmir: Mitsahoi, Ladak Road, 3150 m., R. R. Stewart $10002 a$ (GH); Rach-
ogba, Rupshu, 4020 m., Koelz 2104 (GH); Bok, Zanskar, 3450 m., Koelz 2946a, $2946 b$ (GH-type).
I. M. Johnston (1. c.) considered Rochelia laxa closely related to $R$. macrocalyx and distinguished it from the former species by its much more loosely branched habit, elongate inflorescence, deflexed spreading rather than ascending pedicels, and its coarser obtusish calyx lobes, which only slightly exceed the nutlets. Rochelia laxa appears to me to be very closely related to $R$. peduncularis rather than to $R$. macrocalyx. Rochelia macrocalyx is unique among all the species of the genus in having unguiculate sepals, each with a very strong midrib. The calyx of $R$. laxa is quite different and resembles very much that of $R$. peduncularis in its nonunguiculate, lanceolate and erect calyx lobes. From R. peduncularis it differs in pedicels lacking or to only 0.5 mm . long in flower and much shorter in fruit, at the minimum not twice the length of the calyx. Calyx lobes in $R$. laxa at the fruiting stage are $2.5-4 \mathrm{~mm}$. long, while in $R$. peduncularis they are $4-6 \mathrm{~mm}$. long. In the former species the calyx lobes hardly exceed the nutlets in length, while in the latter they usually exceed the nutlets by $2-4 \mathrm{~mm}$.

## 19. Asperugo L. Sp. Pl. 198. 1753; Gen. Pl. ed. 5. 67. 1754.

## Type species: $A$. procumbens L.

Annual procumbent herb. Flowers small, axillary, subsessile, solitary or in pairs. Calyx in flower divided to the base, much enlarged in fruit, lobes joined below the middle, compressed. Corolla blue, subcylindrical; faucal appendages distinct, semiorbicular. Stamens included. Gynobase columnar, with 4 elevations. Style short. Nutlets 4 , ovoid, strongly flattened with the small circular areola above the middle and clearly to one side of the medial line.

One species, European, widely disseminated as a weed.
A. procumbens L. Sp. Pl. 138. 1753; DC. Prodr. $10: 146,1846$; Boiss. Fl. Orient. 4: 275. 1875; C. B. Clarke in Hook. f. Fl. Brit. India 4: 167. 1883; Brand, Pflanzenr. IV. 252 (Heft 97): 23. 1931; M. Pop. Fl. URSS 19: 530. 1953; Riedl in Rechinger, Fl. Iranica 48 : 96. 1967.

Type: Habitat in Europae ruderatis pinguibus, Herb. No. 189.1 (LinN). Icon.: Reichenb. Icon. Fl. Germ. 18: t. 126. 1858; Brand, 1. c. fig. 1, M-P. 1931.

Annual, procumbent herb. Stems many, to 60 cm . long, flaccid, branched; stem and branches with short, stout, retrorse spinules. Leaves very variable, oblong-lanceolate to oblong-ovate, obtuse to acutish, usually attenuated into a short petiole towards the base, $30-60(-100) \mathrm{mm}$. long, $5-10(35) \mathrm{mm}$. broad, covered on both surfaces densely or sparsely with short, subappressed to subpatent, white trichomes, arising from minute
tuberculate bases. Flowers small, subsessile, solitary or in pairs. Pedicels in fruit $2-7 \mathrm{~mm}$. long, usually reflexed. Calyx divided nearly to the base in flower, ca. 1.5 mm . long, enlarged in fruit to 15 mm ., lobes joined below the middle, with few scattered spinules on the outside, glabrous inside. Corolla blue, $1.5-2 \mathrm{~mm}$. long, lobes rounded, suberect; faucal appendages whitish. Nutlets ovoid, compressed, brownish, minutely verruculose, ca. 2.5 mm . long.

## Distribution: Asia and Europe.

West Pakistan: Attock Dist.: Campbellpore, Iftakhar s.n. (peu). Chitral State: Brumboret Gol, 2000 m., Bowes Lyon 650 (bM); Ziarat, Lowari Pass, 2400 m., Stainton 2340 (bm). Gilgit Agency: Shingo Valley, Duthie s.n. (e); Kohat Dist.: 4 miles from Kohat, on Kohat-Bannu Road, Kazmi s.n. (pes). Kurram Agency: near check post, between Tal and Parachinar, Kazmi $203 a$ (pes). Peshawar Dist.: Between Mardan and Charsadda, Kazmi $482 a$ (pes). Quetta Dist.: Quetta, Sariab Road, 5 km . from Quetta, 1700 m ., Kazmi 1443 (PES); Lamond 899 (E); Rechinger 28823 (w); Peshin, 1700 m., Lace 3472 (E); Quetta, Lace 3465 (E); A. H. Khan s.n. (PFI-M); Kazmi s.n. (PES); Ziarat, Jafri \& Akbar 2128 (E); M. A. Siddiqui 2020 (RAW); Sandeman Tangi, 2 miles from Ziarat, Kazmi $1666 a$ (pes). Swat State: Mingora, Kazmi $432 b$ (PES). Reported from: North Waziristan: Dariawarti, Blatter \& Fernandes s.n.

Kashmir: Chinari, Kazmi $526 a$ (pes); Muzzaffarabad, near the bridge, Kazmi s.n. (PES); Purig, Tangola, Koelz 6090 (US). Reported from: Poonch, R. R. Stewart s.n.; Murpur, R. R. Stewart s.n.

## 20. Omphalodes Moench, Meth. 419. 1794.

Type species: O. linifolia (L.) Moench.
Annual or perennial strigose or villous herbs. Leaves alternate or sometimes the lower opposite. Inflorescence of simple or branched racemes. Calyx divided to the base. Corolla funnelform, campanulate or salverform, lobes patent; faucal appendages, distinct, semilunar. Anthers ovate, included; filaments short. Nutlets depressed-spherical to ovoid, externally umbilicate, dentate to glochidiate, margins usually incurved, attached longitudinally to and exceeding the gynobase.

Species about 24, distributed in Eurasia and Mexico.
O. heterophylla Rech. f. \& H. Riedl in Oesterr. Bot. Zeitschr. 110: 532. 1963; Riedl in Rechinger, Fl. Iranica 48: 98. 1967.

Type: West Pakistan: Swat: Himalaya bor. occid. Kalam, ca. $35^{\circ} 30^{\prime}$ N, $72^{\circ} 30^{\prime} \mathrm{E}$, Substr. granite, ca. 2200 m., 22. 8. 1962, K. H. Rechinger 19442 (w-holotype).

Perennial, tufted, prostrate to rarely ascending herb. Stems numerous, simple to much branched, covered with white spreading trichomes, 7-35 cm . long. Basal leaves lanceolate, petiolate, petioles nearly 10 mm . long,
lamina $30-55 \mathrm{~mm}$. long, $9-18 \mathrm{~mm}$. broad, acute, one nerved, covered on both surfaces with rigid, appressed, white trichomes, arising from distinct tuberculate bases; cauline leaves much smaller than the basal leaves, oblong to oblong-lanceolate, sessile to shortly petiolate, $10-25 \mathrm{~mm}$. long, $3-8 \mathrm{~mm}$. broad; upper cauline leaves, sessile, auriculate. Inflorescence lax, short in flower, elongated in fruit, bracteate, lower bracts $10-18 \mathrm{~mm}$. long, acute, the upper ones $2-10 \mathrm{~mm}$. long, lanceolate, indistinct in the uppermost flowers. Pedicels $2-4 \mathrm{~mm}$. long in flower, recurved, $4-9 \mathrm{~mm}$. long, in fruit. Calyx divided to the base, lobes $2-2.5 \mathrm{~mm}$. long in flower, to 4 mm . long in fruit, patent, incurved at apex. Corolla campanulate, blue, 3 mm . long, slightly exceeding the calyx, corolla tube equalling or slightly shorter than the calyx, lobes suborbicular, patent, $1-1.5 \mathrm{~mm}$. long, faucal appendages much broader than long, incurved. Anthers minute, filaments scarcely distinct, inserted at the middle of the corolla tube. Style 1-$1.5(-2) \mathrm{mm}$. long, stigma capitate or indistinctly bifid. Nutlets ovoid, subacute, 2 mm . long, margins swollen, dorsal face more or less plane, sparsely tuberculate-aculeate, ventrally densely tuberculate, carinate below and sometimes also above the areola, areola orbicular at base, narrow at apex, covering $2 / 3$ length of the nutlet ventrally. Gynobase short, narrow, conical.

Distribution: West Pakistan.
West Pakistan: Chitral State: Drosh, Beorai, 4000 m., Bowes Lyon 198 (bm, e). Swat State: Kalam, 2200 m., Rechinger 19442 (w-type).
21. Paracaryum (DC.) Boiss. Diagn. Pl. Orient. 11: 128. 1849.

Omphalodes Moench, Sect. Paracaryum DC. Prodr. 10: 159. 1846.
Omphalodes Moench, Sect. Mathia DC. Prodr. 10: 169. 1846, pro parte.
Type species: P. rugulosum (A.DC.) Boiss. (lectotype species).
Annual, biennial or perennial, erect, decumbent or prostrate herbs. Basal leaves many, usually with long petioles; cauline leaves usually sessile. Inflorescence short in flower, later elongated, ebracteate to bearing several bracts. Calyx divided to the base, lobes more or less enlarged in fruit. Corolla blue to various shades of purple-brown, infundibuliform, subcampanulate or cylindrical, lobes usually short; faucal appendages present. Anthers usually included, rarely with exserted apices, elliptical to linear; filaments distinct. Style usually shorter than the calyx; stigma capitate. Nutlets 4 , dorsal middle area smooth, aculeolate or glochidiate, often carinate, margins winged, wings inflexed, entire to lacerate, bearing glochidia, membranous, attached ventrally throughout their length to the narrow, conical gynobase.

Species about 15, distributed from northeast Africa to south and southeast Russia, Arabia, Iran, Afghanistan, West Pakistan, Kashmir and northwest India.

## Key to the Species

ค. Species perennial; nutlets $5-7 \mathrm{~mm}$. long.
b. Nutlets 5 mm . long; pedicels in fruit ca. 4 mm . long; calyx lobes 4 mm . long, linear-oblong, not enlarged in fruit; corolla cylindrical-campanulate.

1. P. rugulosum.
b. Nutlets $6-7 \mathrm{~mm}$. long; pedicels $7-12 \mathrm{~mm}$. long in fruit; calyx lobes ca. 4 mm . long in flower, enlarged in fruit to 6 mm ., lanceolate; corolla infundibuliform.
2. P. platycalyx.
a. Species annual; nutlets $2.5-4(-5) \mathrm{mm}$. long.
c. Nutlets ovoid, 4-5 mm. long; basal leaves distinctly petiolate.
3. P. calathicarpum.
c. Nutlets round, $2.5-4 \mathrm{~mm}$. in diameter; basal leaves indistinctly petiolate.
4. P. intermedium.
5. P. rugulosum (DC.) Boiss. Diagn. Pl. Orient. 11: 129. 1848; Fl. Orient. 4: 256. 1875; Aitch. Bot. Afgh. Delim. Comm. 89. 1888; Brand, Pflanzenr. IV. 252 (Heft 78) : 48. 1921; Riedl in Rechinger, Fl. Iranica 48: 99. 1967.

Omphalodes rugulosa DC. Prodr. 10: 160. 1848.
Paracaryum rubriflorum Stocks in Jour. Bot. Hook. 4: 175. 1852.
Type: In monte Horeb Arabiae Petreae, Aucher s.n. (G).
Icon.: Brand, l. c. fig. 5, A-F. 1921.
Perennial, erect herb, $10-40 \mathrm{~cm}$. tall. Stems solitary or few, branched, branches long; stems and branches densely covered with thick, usually retrorse, subpatent, white to grayish trichomes to 2 mm . long, arising from tuberculate bases. Basal and some of the lower cauline leaves petiolate, linear-lanceolate to oblong-lanceolate, acute, margins entire, (including petioles) $40-170 \mathrm{~mm}$. long, $2-15 \mathrm{~mm}$. broad, densely covered on both surfaces with trichomes like those of the stem; cauline leaves sessile, shorter and narrower. Pedicels to 2 mm . long in flower, to 6 mm . long, densely pubescent, recurved in fruit. Calyx divided to the base, lobes in flower ca. 4 mm . long and 1 mm . broad, oblong, densely pubescent with retrorse, subpatent trichomes, to 5 mm . long and 2 mm . broad in fruit. ovate to ovate-lanceolate, acutish, subpatent, rarely reflexed. Corolla purple-violet to bluish-violet, cylindrical-campanulate, 4-5 mm. long, tube more or less equalling the limbs, limbs divided to the middle into more or less patent lobes; faucal appendages present. Style $2-3 \mathrm{~mm}$. long. Nutlets to 6 mm . long and 5 mm . broad, ovate, broadly winged at the margins, wings incurved, rugulose, irregularly dentate on the inner margin, dorsally sometimes tuberculate; dorsal middle area smooth or bearing few vertical appendages, appendages at apex glochidiate.

Distribution: Egypt, Arabia, Iran, West Pakistan.
West Pakistan: Quetta Dist.: Quetta, Dick-Peddie 315 (MICH); Gwal, 2000 m., 24. 4. 1888, Lace s.n. (E) ; Zarghun, 2200 m., Lace 3731 (E). Miscellaneous: Baluchistan, Herb. Ind. Or. Hook, f. \& Thoms., Stocks s.n. (GH-isotype of P. rubriforum Stocks). Reported from: Quetta, Khanozai, Duthie (?) 18924 (DD).
2. P. platycalyx Riedl, Oesterr. Bot. Zeitschr. 110: 535. 1963; in Køie \& Rechinger, Biol. Skr. 13(4) : 205. 1963; in Rechinger, Fl. Iranica 48: 102. 1967.

Type: Afghanistan: Herat, Jija, 900 m., Køie 4404 (w-holotype, cisotype).

ICON.: Riedl, 1. c. fig. 156. 1963.
Perennial, erect to ascendent, $15-25 \mathrm{~cm}$. tall. Stems many, branched, covered densely with up to 2 mm . long, thick, patent, white trichomes arising from minute tuberculate bases. Basal leaves petiolate, (including petioles) $70-130 \mathrm{~mm}$. long, $7-10 \mathrm{~mm}$. broad, petioles usually longer than the lamina, lamina lanceolate, tapering at both ends, acutish, margins plane, covered on both surfaces with subpatent, more or less retrorse trichomes, like those of the stem; cauline leaves sessile, sometimes more or less semiamplexicaul, gradually reduced in size upwards. Pedicels 2 mm . long in flower, to 12 mm . long in fruit, more or less recurved. Calyx divided to the base, lobes oblong-ovate, densely hairy, in flower ca. 4 mm . long, 1 mm . broad, enlarged in fruit to 6.5 mm . long and 2.5 mm . broad, lanceolate, spreading. Corolla blue to purplish-blue, infundibuliform, $6-7$ $(-8) \mathrm{mm}$. long, tube longer than limb, lobes broad, rounded; faucal appendages broader than long. Style $2-3 \mathrm{~mm}$. long. Nutlets up to $6(-7) \mathrm{mm}$. long, $5-6 \mathrm{~mm}$. broad, ovate, broadly winged at the margins, wings incurved, rugulose, irregularly dentate on the inner margins, middle dorsal area indistinctly carinate, smooth or bearing few vertical appendages, appendages glochidiate at their apices.

## Distribution: Afghanistan, West Pakistan.

West Pakistan: Kalat State: Surab to Kalat, ca. 20 km . from Surab, 1800 m ., Kazmi $1312 a$ (Pes); Lamond 669 (e); Rechinger 28345 (w). Quetta Dist.: circa 50 km . from Quetta, Chiltan, between Dulai and Kanak, 1600 m ., Kazmi 1549 (GH, PES); Lamond 1093 (E); Rechinger 29118 (W, G); Bolan Pass, south of Quetta, 1500 m., Kazmi 1397 (Pes); Lamond 883 (E); Rechinger 28795 (w).

Paracaryum platycalyx is very closely related to $P$. rugulosum in the form of its leaves, flowering parts, and nutlets and can only be differentiated from the former species by its larger nutlets, pedicels longer in fruit, and the slightly longer fruiting calyx lobes.

With the little material from our area available for study, the differences between the two species appear only in the dimensions of pedicels, calyx lobes, and nutlets, and not in their shape or structure. It is possible that on examining more material Paracaryum platycalyx may prove to be only a variation of $P$. rugulosum.
3. P. calathicarpum (Stocks) Boiss. Fl. Orient. 4: 254. 1875; Brand, Pflanzenr. IV. 252 (Heft 78) : 48. 1921; Riedl in Rechinger, Fl. Iranica 48: 104. 1967.

Type: Baluchistan superior, Stocks 1003 (k-holotype, G-isotype).
Icon.: Riedl in Køie \& Rechinger, Biol. Skr. 13(4): 204. fig. 154, 155. 1963; in Rechinger, Fl. Iranica, 1. c. t. 19. fig. 2. 1967.

Annual, erect, up to 25 cm . tall. Stem usually solitary, much branched, branches long, divaricate; stem and branches covered with thin, crisped, subappressed, antrorse trichomes, to 0.5 mm . long, arising from minute tuberculate bases. Basal leaves oblong-spathulate, petiolate, (including petioles) to 50 mm . long and $8-10 \mathrm{~mm}$. broad, apices obtuse to roundish, gradually narrowed towards the base into a short petiole, loosely covered on both surfaces with very short, crisped, patent to subappressed white trichomes, arising from large tuberculate bases; lower cauline leaves very short petiolate, the upper sessile, gradually reduced in size. Pedicels in flower lacking to 0.5 mm . long, in fruit to 4 mm . long, stout, pubescent, more or less reflexed. Calyx divided to the base, lobes oblong, acute, pubescent, $1-1.5 \mathrm{~mm}$. long in flower, enlarged in fruit to $2.5-3 \mathrm{~mm}$. long, spreading. Corolla blue, campanulate, $1.5-2 \mathrm{~mm}$. long, limb shorter than the tube, lobes minute. Style ca. 0.5 mm . long, pubescent. Nutlets ovoid, $4-5 \mathrm{~mm}$. long, $3.5-4 \mathrm{~mm}$. broad, margins broadly winged, wings inflexed, laterally blistered, blisters in many rows, those of the outer row slightly elongate to partly mammillate, dorsally rugulose, tuberculate, inner margins irregularly dentate, middle dorsal area tuberculate to vertically appendiculate, appendages glochidiate at apex; one pair of opposite nutlets usually with narrower marginal wings.
Distribution: Afghanistan, West Pakistan.
West Pakistan: Makran Dist.: 70 km . northeast of Panjgur, $1100 \mathrm{~m} .$, Kazmi 12716 (pes); Rechinger 28221 (w); Nag, between Panjgur and Surab, 1300 m., Kazmi 1278 (pes); Lamond 632 (e); Rechinger $28260 a$ ( $\mathrm{c}, \mathrm{w}$ ). Quetta Dist.: 20 km . west of Quetta, Kazmi 1589 b (pes); Rechinger 29081 (w). Miscellaneous: Baluchistan superior, Stocks 1003 (к). Reported from: Quetta, inter Zhob et Sambaza, 26 km . north of Fort Sandeman versus Wana, 1500 m ., Rechinger 24844 (w); infra Mach versus Ab-e-Gum, Rechinger 28484 (w); Panjgur, 1000 m., Rechinger 28177(w).
4. P. intermedium (Fresen.) Lipsky, Acta Horti Petrop. 26(2): 487. 1910; Brand, Pflanzenr. IV. 252 (Heft 78) : 47. 1921; M. Pop. Fl. URSS 19: 602. 1953; Riedl in Rechinger, Fl. Iranica 48: 105. 1967.
Cynoglossum intermedium Fresen. in Mus. Senckenb. 1: 169, 1834.
Omphalodes intermedia Decne. Ann. Sci. Nat. Paris 2: 255, 256. 1834.
Paracaryum micranthum (DC.) Boiss. Diagn. Pl. Orient. 11: 129. 1849; Fl. Orient. 4: 255. 1875.
Omphalodes micrantha DC. Prodr. 10: 159. 1846.
Type: not indicated.
Icon.: Riedl, l. c. 48: t. 19. fig. 4. 1967.
Annual, erect to ascending herb, $5-30 \mathrm{~cm}$. tall. Stems solitary to many, branched near the base, branches long, delicate, more or less spreading,
covered with crisped patent to subappressed white trichomes to 0.5 mm . long, arising from minute tuberculate bases. Basal leaves usually obtuse sometimes acutish, entire, $20-40 \mathrm{~mm}$. long, $3-6 \mathrm{~mm}$. broad, attenuated towards the base into a very short to indistinct petiole, covered on both surfaces with thick, patent, white trichomes to 1 mm . long, arising from large, white, tuberculate bases; cauline leaves sessile, linear-oblong, gradually reduced in size upwards. Inflorescence long, lax, usually bracteate in the lower part, bracts $1-2$. Pedicels very short in flower, elongated to 15 mm . in fruit, pubescent, suberect to horizontal or sometimes reflexed. Calyx divided nearly to the base, lobes $1-1.5 \mathrm{~mm}$. long in flower, 2-3.5 mm . long in fruit, linear to oblong-ovate, obtuse to acute. Corolla blue, campanulate to cylindric-campanulate, $1.5-2.5 \mathrm{~mm}$. long, limbs subequal to little shorter than the tube; faucal appendages semilunar to subquadrate. Anthers attached to the middle of the corolla tube. Nutlets roundish, $2.5-4 \mathrm{~mm}$. in diameter, broadly winged at the margins, wings inflexed, leaving a small to large aperture in the middle, more or less longitudinally rugulose, sometimes with few tubercles or densely minutely papillate, inner margin forming the aperture lobed, irregularly dentate or pubescent, middle dorsal area aculeate or vertically appendiculate, appendages glochidiate.

Distribution of species: Egypt, Arabia, Iran, Afghanistan, West Pakistan, Caspian Aral, Pamir Alaj, Kizil Kum, Tien Shan.

## Key to the Varieties

a. Inflexed marginal wings of the nutlets densely white papillate on the upper surface.

4c. var. papillosum.
a. Inflexed marginal wings of the nutlets glabrous or rarely inconspicuously papillate.
b. Aperture formed by the inflexed marginal wings of the nutlets very small, stellate.
b. Aperture formed by the var, stellatum. roundish. 4a. var. intermedium.

4a. Var. intermedium.
Basal leaves linear-spathulate; cauline leaves linear-oblong, obtuse. Pedicels $5-15 \mathrm{~mm}$. long in fruit. Calyx lobes oblong-ovate. Corolla campanulate, limb subequalling the corolla tube. Inflexed marginal wings of the nutlets dorsally glabrous, rarely indistinctly minutely papillose; margin forming the central aperture subentire to irregularly dentate or lobed.

## Distribution of var.: as that of species.

West Pakistan: Quetta Dist.: 8 miles northwest of Harnai, 900-1200 m., Kazmi 1645b (pes); Rechinger 29556 (w); near Ziarat, 2400 m., Kazmi $1656 b$ (Pes); Jafri \& Akbar 2145 (BM, e). Miscellaneous: Baluchistan, Herb. Ind. Or. Hook. f. \& Thoms., Stocks s.n. (GH-as Omphalodes micrantha). Reported from:

South Waziristan, Tank, Williams; Quetta, Wam Tangi, 1500 m ., Munro; Fort Sandeman, 1500 m., in Herb. Dehra Dun; Shinger, 50 km., N. Fort Sandeman, 2000 m., Rechinger 29898 (w); 38 km. E. Gumbaz, 1000 m., Rechinger 29695 (w); Kalat State: Inter Kolpur et Mach, 900-1800 m., Rechinger 28432, 28437 (w).

4b. Var. stellatum (H. Riedl) Kazmi, comb. nov.
Paracaryum stellatum H. Riedl in Rechinger, Fl. Iranica 48: 104. 1967.
Type: West Pakistan: Kalat, inter Kolpur et Mach, 900 m., K. H. Rechinger 28434 (w).

ICON.: Riedl, 1. c. 48 : $t .19$. fig. 3. 1967.
Basal leaves oblong to linear-oblong; cauline leaves linear to linearlanceolate, acutish. Pedicels to 6 mm . long in fruit. Calyx lobes linear, acutish. Corolla campanulate, limbs subequal to the corolla tube. Inflexed margin of the nutlets, dorsally glabrous or rarely indistinctly papillose, margin forming the central aperture dentate, teeth triangular, central aperture stellate.

## Distribution of var.: West Pakistan, Afghanistan.

West Pakistan: Kalat State: between Kolpur and Mach, 900 m., Rechinger 28438 (w-holotype); Kazmi 1331d (pes). Quetta Dist.: Inter Qila Abdullah et Sheila Bagh, 1600-1900 m., Rechinger 29033 (w); Saranan, 8-9 miles north of Quetta, Kazmi 1501 ( PES ); Spin Karez, Kazmi $1615 b$ (PES).

4c. Var. papillosum (DC.) Kazmi, comb. nov.
Omphalodes papillosa DC. Prodr. 10: 159. 1846.
Paracaryum papillosum (DC.) Gürke in Engl. \& Prantl, Nat. Pflanzenfam. IV. 3a: 105. 1893; Riedl in Rechinger, Fl. Iranica 48: 105. 1967.

Type: Ad montem Sinai, Schimper 123 (G-holotype, GH-isotype).
Basal leaves oblong to linear-oblong; cauline leaves linear to linearlanceolate, acutish. Pedicels to 10 mm . long in fruit. Calyx lobes more or less linear, acutish. Corolla cylindrical-campanulate, broad at the mouth, limb much shorter than the corolla tube. Inflexed marginal wings of the nutlets dorsally densely and minutely papillose, forming the central aperture at the margins, subentire, lobed or irregularly dentate, aperture broad.

Distribution of var.: as that of species.
West Pakistan: Makran Dist.: Near Nag, Kazmi $1258 b$ (pes). Quetta Dist.: between Wam Tangi and Akhtari, Kazmi 1763 (pes); Wam Tangi, Munro s.n. (к); Harnai, Lace 2699 (G); Ziarat, Santapau 6452 (GH). Reported from: Inter Kolpur and Mach, Rechinger 28433.

Paracaryum intermedium is very variable in the form of its leaves, in the length of pedicels, and in the margin and surface of the inflexed wings of the nutlets. Because the distinguishing characters are not very constant
and since intermediate forms are found, I consider $P$. stellatum and $P$. papillosum only variations of $P$. intermedium.

## 22. Mattiastrum (Boiss.) Brand, Repert. Sp. Nov. 14: 150. 1915.

Paracaryum Boiss. Sect. 2. Mattiastrum Boiss. Diagn. Pl. Orient. 11: 130. 1849.

Type species: not indicated.
Usually perennial or biennial, rarely annual herbs. Inflorescence terminal to axillary, ebracteate or rarely bearing 1-2 bracts. Calyx usually divided to the base, lobes 5, not at all to slightly enlarged in fruit. Corolla subcylindrical, to infundibuliform or hypocrateriform, limb obviously distinct from the corolla tube, faucal appendages 5 , conspicuously developed inside the corolla throat. Anthers included. Nutlets usually winged at the margins, sometimes the wings of the pair of two opposite nutlets reduced, wings plane, to rarely slightly incurved, never inflexed as in Paracaryum, middle dorsal area not covered by the wings, wings dentate to appendiculate at the margins, appendages glochidiate, nutlets attached throughout their length to the narrow columnar gynobase.

Species about 30, distributed in southwestern Asia.

## Key to the Species

a. Calyx lobes $3-5 \mathrm{~mm}$. long in flower; corolla $10-12 \mathrm{~mm}$. long.

1. M. asperum.
a. Calyx lobes 1-2 mm. long in flower; corolla 2-4 mm. long.
b. Basal leaves (including petioles) $100-140 \mathrm{~mm}$. long, $30-45 \mathrm{~mm}$. broad, ovate to oblong-ovate. .......................... 4. M. thomsoni.
b. Basal leaves (including petioles) to 90 mm . long and 15 mm . broad, oblong-lanceolate to oblong-spathulate.
c. Nutlets $5-8 \mathrm{~mm}$. long.
d. Plants spreading pubescent; pedicels to 1 mm . long in flower, to $6(-8) \mathrm{mm}$. long in fruit, slender; corolla blue; style $1.5-2 \mathrm{~mm}$. long.
2. M. howardii.
d. Plants appressed pubescent; pedicels lacking in flower, in fruit to 2 mm . long, thick; corolla bluish-white to pink; style $0.5-1 \mathrm{~mm}$. long.
c. Nutlets $2-4 \mathrm{~mm}$. long.
e. Plants erect to ascendent; stem stout, thick; basal leaves many; marginal wings of the nutlets plane at the edges, dentate, teeth blunt not glochidiate at apex. ...............5. 5. M. tibeticum.
e. Plants erect to prostrate, stem weak, slender; basal leaves $1-2$ or missing; marginal wings of the nutlets recurved at the edges, dentate, teeth produced, glochidiate at apex. .....6. 6. M. bungei.
3. M. asperum (Stocks) Brand, Repert. Sp. Nov. 14: 153. 1915; Pflanzenr. IV. 252 (Heft 78) : 61. 1921; Riedl in Rechinger, Fl. Iranica 48: 114. 1967.

Paracaryum asperum Stocks in Jour. Bot. Hook. 4: 175. 1852; Boiss. Fl. Orient. 4: 261. 1875.
Mattiastrum honigbergeri Rech. f. Ann. Naturh. Mus. Wien 55: 14. 1947; Riedl in Rechinger, Fl. Iranica 48: 114. 1967, syn. nov.

Type: Baluchistan superior, Stocks 906 (K).
Icon.: Riedl in Køie \& Rechinger, Biol. Skr. 13(4) : 213. fig. 164. 1963 (under M. honigbergeri).

Shrubby perennial, $20-60 \mathrm{~cm}$. tall. Stems many, branched, branches long; stem and branches covered with crisped, patent, thick, white trichomes to 2 mm . long, arising from tuberculate bases. Basal leaves petiolate, (including petioles) to 100 mm . long, 12 mm . broad, oblong-ovate, obtuse, attenuated towards the base, both surfaces covered densely with short trichomes to 1 mm . long intermixed with thick trichomes to 2.5 mm . long, all arising from prominent tuberculate bases and more or less spreading; middle cauline leaves linear-oblong, sessile, little shorter than the basal ones; upper cauline leaves much shorter and narrower. Inflorescence terminal or axillary, lax, much elongated in fruit. Pedicels $1-2 \mathrm{~mm}$. long in flower, elongated to 6 mm . in fruit, usually erect or sometimes reflexed. Calyx divided to the base, lobes linear-oblong, acute, densely pubescent, $3-4(-5) \mathrm{mm}$. long in flower, slightly enlarged in fruit. Corolla purple-violet to blue, cylindrical-infundibuliform, $6-12 \mathrm{~mm}$. long, limb more or less equalling the corolla tube, lobes short; faucal appendages semilunar. Nutlets $(6-) 8-10 \mathrm{~mm}$. in diameter, broadly winged at the margins, wings dentate, teeth triangular, usually glochidiate at apex, dorsal middle area vertically appendiculate, appendages glochidiate.

## Distribution: West Pakistan, Afghanistan.

West Pakistan: Quetta Dist.: Urak, 2000 m ., Santapau 6731 (GH); R. R. Stewart 691 (MICH); Ziarat, Sandeman Tangi, 2 miles from Ziarat, 2500 m., Kazmi 1660 (PES); Quetta to Ziarat at top of Pass, 2500 m ., Lamond 1868 (E); Rechinger 29056 (w); Ziarat, Swiss Zool. Mission (May, 1953), s.n. (BM); between Qila Abdullah and Sheila Bagh, Kazmi 1533 (PES); Quetta to Chaman, Khojak Pass, above Sheila Bagh, 2000-2300 m., Lamond 1068 (E); Rechinger 29056 (w); Ziarat, Santapau 6435 (GH). Miscellaneous: Baluchistan, in Herb. Ind. Or. Hook. f. \& Thoms., Stocks s.n. (GH-probable duplicate of Stocks 906). Reported from: Quetta, Tak, Rechinger 28402 (w); Gwal versus Surkh, Kakar in valley Lora, Lace s.n.; Chiltan inter Dulai et Kanak, 1600 m., Rechinger 29119 (w) ; Gwoshki, 2100-2400 m., Munro(?) ; Kawas Tangi, 1800 m., Munro(?); Zarghun, 1500 m ., Lace 3731 in part (E).

The only distinguishing character cited between Mattiastrum asperum and $M$. honigbergeri is the length of corolla which, in the former species is said to be 10 to 12 mm . and in the latter 6 to 8 mm . The specimens I examined, show a variation in the length of corolla between 6 to 12 mm . and $M$. honigbergeri represents the variation with shorter corollas.
2. M. himalayense (Klotzsch) Brand, Repert. Sp. Nov. 14: 156. 1916;

Pflanzenr. IV. 252 (Heft 78) : 65. 1921; Riedl in Rechinger, Fl. Iranica 48 : 116. 1967.

Mattia himalayensis Klotzsch in Bot. Ergebn. Reis. Prinz Waldemar Bot. 94. t. 64. 1862.

Paracaryum himalayense (Klotzsch) C. B. Clarke in Hook. f. Fl. Brit. India 4: 161. 1883; Gürke in Engl. \& Prantl, Nat. Pflanzenfam. IV. 3a: 105. fig. 42, L-O 1893; M. Pop. in Fl. URSS 19: 597. 1953.
Type: Himalaya, Hoffmeister s.n. (HEID).
Icon.: Riedl in Køie \& Rechinger, Biol. Skr. 13(4): 212. fig. 162, 163. 1963; Klotzsch, l. c. t. 64. 1862; Gürke, 1. c. fig. 42, L-O. 1893; Brand, l. c. fig. 10, L-O. 1921 ; M. Pop. 1. c. $t$. 30. fig. 1. 1953.

Biennial to perennial, erect, to 60 cm . tall. Stems solitary to many, branched, branches long, more or less divaricate; stem and branches densely covered with subpatent to subappressed white trichomes $0.5-1 \mathrm{~mm}$. long, not arising from tuberculate bases, sometimes intermixed with thicker trichomes to 1 mm . long, arising from prominent tuberculate bases. Basal leaves (including petioles) $50-90 \mathrm{~mm}$. long, $5-15 \mathrm{~mm}$. broad, oblong, ob-long-lanceolate or lance-spathulate, obtuse, margins sometimes slightly revolute, densely covered on both surfaces with variable, very thin to quite thick, appressed to subpatent, white trichomes $0.5-1 \mathrm{~mm}$. long, arising from tuberculate bases or not; cauline leaves sessile, lanceolate, much reduced in size. Inflorescence terminal and axillary, much contracted in flower, elongated in fruit, lax. Pedicel absent in flower, in fruit stout, hairy, erect or horizontal, rarely reflexed, usually $1-2 \mathrm{~mm}$. long. Calyx divided nearly to the base, in flower $1.5-2 \mathrm{~mm}$. long, in fruit elongated to 3 mm ., ovate to oblong, obtuse, hairy. Corolla bluish-white to pink, $2-4 \mathrm{~mm}$. long, cylindric-campanulate, tube slightly longer than the limb; faucal appendages trapeziform. Nutlets suborbicular, 5-7(-8) mm . in diameter, marginal wings broad, plane or slightly curved at the bluish, broadly dentate margins, teeth triangular, bearing glochidia at apex. Stigma 0.51 mm . long.

Distribution of species: Afghanistan, Pamir Alaj, West Pakistan, Kashmir, northwest India.

## 2a. Var. himalayense

Plants biennial; stem solitary, slender, less branched, branches not much spreading.

West Pakistan: Gilgit Agency: Baltistan, Chorbat, 3000 m., Hunter-Winston 10246 (к). Miscellaneous: Himalaya, Herb. Ind. Or. Hook. f. \& Thoms., Thomson s.n. ( K -as Omphalodes no. 4).

Kashmir: Reported from: Ladak, 4600 m ., Meebold 4236.
2b. Var. fallax (Rech. f. \& H. Riedl) Kazmi, comb. nov.
Mattiastrum himalayense subsp. fallax Rech. f. \& H. Riedl in Rechinger, Fl. Iranica 48: 117. 1967.

Type: Afghanistan: Bareki Chaidan, on the way to Band-e-Amir, 2800 m., Hedge \& Wendelbo 4719 (BG).

Icon.: Riedl, 1. c. $t .22 .1967$.
Plants perennial, stems many, stout, much branched, branches divaricate.
West Pakistan: Gilgit Agency: Baltistan: Shagarthang Valley, 3000 m., Duthie 12, 140 (к).

Kashmir: Zaskar: Seni, Phe, 3600 m., Koelz 5821 (GH, MICH, us); Kargia, 4300 m., Koelz 5470 (GH, MICH, Us); Ladak: Rabila, Koelz 6153 (MICH, Us).

Riedl (l. c. 1967) recognized the perennial, many stemmed form as subspecies fallax, considering it to be confined to Afghanistan or possibly extending to Pamir Alaj and thus representing the western area of distribution of the species Mattiastrum himalayense. The specimens I examined show that this form extends to West Pakistan, Kashmir, and even to northwest India, [Kangra Dist.: Spiti Valley, Dankhar, 4000 m., Bhagwan Singh 256 (MICH)] and covers the same area as the typical form. Therefore, I consider both taxa only varieties of M. himalayense. The diameter of the nutlets in variety fallax has been given by Riedl as 7 to 8 mm ., which is so only rarely. Usually the nutlets are the same size in both varieties.

## 3. M. howardii ${ }^{2}$ Kazmi, sp. nov.

Type: West Pakistan: Gilgit Agency, Dist. Astore, 7800 ft., 25. 7. 1892, J. F. Duthie s.n. (BM-holotype, e-isotype).

Herba annua vel biennis (?), erecta ad 35 cm . alta. Caulis plerumque solitarius, interdum $2-3$, striatus, ramosus, rami ad 20 cm . longi, plusminusve divaricati; caules ramique pilis albis patentibus rigidis, ad basim manifeste tuberculatis, vestiti. Folia basalia petiolata, ad $40-60 \mathrm{~mm}$. longa (petiolis inclusis) et $5-10 \mathrm{~mm}$. lata, oblongo-ovata, obtusa vel subrotundata ad apices, ad basim attenuata, supra infraque dense pilosa, pili tenues albi; petioli, praecipue ad margines, pilis ad 1.5 mm . longis; folia caulina media pauca, sessilia, lanceolata, acuta, basim apicemque attenuata, quam folia basalia angustiora brevioraque, pilis longioribus sparse vestita, pili ad basim tuberculati. Inflorescentia ad anthesin brevis, in fructu perelongata, laxa, interdum 1-2-bracteata. Pedicellus ad anthesin $\pm 1 \mathrm{~mm}$. longus, hirsutus, in fructu perelongatus et usque ad $6(-8) \mathrm{mm}$. longus, tenuis, erectus, raro deflexus. Calyx ad basim divisus, lobi ad anthesin $1.5-2 \mathrm{~mm}$. longi, oblongi, in fructu accrescentes ad 3-4 mm. longi et 1 mm . lati, erecti. Corolla caerulea, ca. 2 mm . longa, cylindrico-campanulata, tubus quam limbus longior, lobi $0.7-8 \mathrm{~mm}$. longi, ovati; appendices faucales suborbiculares. Antherae 0.6 mm . longae, oblongae, ad medium tubi corollae insertae. Nuculae subrotundatae, $6-7 \mathrm{~mm}$. diam. ad margines alatae, alae ca. 2 mm . latae, ad margines complanatae, late

[^1]dentatae, dentes ad apicem glochidiati; pars media dorsalis verticale appendiculata, appendices apice glochidiatae, paginae laterales ventralesque minute tuberculatae. Stylus $1.5-2 \mathrm{~mm}$. longus.

## Distribution: West Pakistan.

West Pakistan: Gilgit Agency: Astore, 2500 m., Duthie s.n. (bm, e) ; Gurikot to Godai, on Gilgit road, 2650 m., R. R. Stewart 18930 (GH) ; Gurikot to Das Kirini, 2500-2700 m., R. R. Stewart 22979 (GH).

The new species, Mattiastrum howardii, is closely related to Mattiastrum himalayense, from which it differs in the loose, always spreading, uniform trichomes on the stem, branches, and leaves; in the subsessile to short ( 1 mm .) pedicellate flowers, the slender, erect or rarely slightly reflexed pedicels elongating to $6(-8) \mathrm{mm}$. in fruit; and the blue corolla with style $1.5-2 \mathrm{~mm}$. long. In $M$. himalayense the trichomes on the stems, branches, and leaves are dense, subappressed, and of different lengths, the flowers always sessile, the fruits subsessile or short pedicellate, the thick, stout pedicels never exceeding 2 mm . in length, the bluish-white to pink corolla and the style $0.5-1 \mathrm{~mm}$. long. The specimens cited above are annual, not perennial.

## 4. M. thomsonii (C. B. Clarke) Kazmi, comb. nov.

Paracaryum thomsonii C. B. Clarke in Hook, f. Fl. Brit. India 4: 161. 1883; Brand, Pflanzenr. IV. 252 (Heft 78): 48. 1921.

Type: Alpine western Tibet: Nubra, Baltal, Herb. Ind. Or. Hook. f. \& Thoms., Thomson s.n. (к-as Echinospermum no. 2).

Robust perennial with roots and lower part of the stems woody, up to $50(-100$ ?) cm. tall. Stems usually many, erect, much branched, branches spreading, stems and branches densely covered with patent, white trichomes $0.5-1 \mathrm{~mm}$. long, arising from minute inconspicuous tuberculate bases. Basal leaves many, forming rosettes, petiolate, (including petioles) 100-140 mm. long, $30-45 \mathrm{~mm}$. broad, ovate to oblong-ovate, coriaceous, gradually or abruptly narrowed into a petiole towards the base, (petiole usually shorter than the lamina) entire, cuspidate, midrib and veins prominent on the lower surface, covered sparsely on the upper surface, densely on the lower surface with short, patent, white trichomes, arising from prominent, white, tuberculate bases, petioles with longer trichomes on the margins towards the base; lower cauline leaves more or less like the basal ones, upper cauline leaves sessile, much shorter and narrower. Inflorescence terminal or axillary short in flower, elongated in fruit, spreading; peduncles usually with one or two bracts. Pedicels lacking to 0.5 mm . long in flower, (1) $2-3(-5) \mathrm{mm}$. long in fruit, stout, horizontal to sometimes reflexed. Calyx divided nearly to the base, lobes ovate, obtuse, hairy externally, glabrous internally $2.5-3 \mathrm{~mm}$. long and $1-1.5 \mathrm{~mm}$. broad, not much elongated in fruit. Corolla white, in dried specimens $2.5-3.5 \mathrm{~mm}$. long, campanulate, limb equalling or little shorter than the corolla tube,
lobes 1.25 mm . long and broad, sometimes broader; faucal appendages subquadrate, emarginate. Anthers attached to the middle of the corolla tube. Nutlets $5-6 \mathrm{~mm}$. long, $4-5 \mathrm{~mm}$. broad, broadly ovate, winged at the margins, wings $1-1.5 \mathrm{~mm}$. broad, plane at the margins to very slightly recurved, broadly dentate, teeth triangular, bearing glochidia at apex, dorsal middle area vertically appendiculate, appendages glochidiate. Style up to 1 mm . long.

Distribution : Kashmir, Tibet.
Kashmir: Ladak: near Kharbu, 3000 m., R. R. Stewart 21106 (GH); Olding near Indus river, 2800 m., R. R. Stewart 21032 (GH).
5. M. tibeticum (C. B. Clarke) Brand, Repert. Sp. Nov. 14: 156. 1915; Pflanzenr. IV. 252 (Heft 78) : 66. 1921.

Paracaryum tibeticum C. B. Clarke in Hook. f. Fl. Brit. India 4: 162. 1883.
P. tibeticum var, schlagintweitii Brand, Pflanzenr. IV. 252 (Heft 78): 66. 1921, syn.nov.

Type: Ladakh, 12000-14000 ped., Herb. Ind. Or. Hook. f. \& Thoms., Thomson s.n. (к-holotype, BM-, GH-isotypes, as Omphalodes no. 6).

Annual, erect to ascending herb, to 35 cm . tall. Stems solitary or few, more or less dichotomously branched, branches long, suberect to spreading, covered densely on the lower parts with spreading trichomes to 1 mm . long, arising from minute tuberculate bases and on the upper part with short, antrorsely appressed trichomes to 0.5 mm . long, apparently not arising from tuberculate bases. Basal leaves oblong to oblong-ovate, gradually narrowed towards the base into a short petiole, to 6 cm . long and $5-7 \mathrm{~mm}$. broad, covered on both surfaces with short white trichomes arising from prominent white tuberculate bases; lower cauline leaves oblong-lanceolate with shorter petioles; upper cauline leaves sessile, much shorter and narrower. Inflorescence terminal, lax, elongated in fruit. Pedicels erect, hairy, lacking or to 0.5 mm . long in flower, $2-3 \mathrm{~mm}$. long in fruit, rarely those of the lowermost fruits elongated to 6 mm ., reflexed. Calyx divided to the base, lobes in flower erect, $1-1.5 \mathrm{~mm}$. long, spreading or reflexed in fruit, 2.5 mm . long. Corolla light to deep blue, cylindri-cal-campanulate, ca. 2 mm . long, limb subequal to the corolla tube, lobes roundish, spreading; faucal appendages broader than long. Anthers attached to the middle of corolla tube. Fruit orange-red. Nutlets ovoid, $3-4 \mathrm{~mm}$. long, $2.5-3.5 \mathrm{~mm}$. broad, winged at the margin, wings ca. 1 mm . broad, plane at the margins, distantly minutely dentate, teeth at apex not glochidiate, middle dorsal area tuberculate to vertically appendiculate, appendages glochidiate at their apices. Style $0.5-1 \mathrm{~mm}$. long.

Distribution: West Pakistan, Kashmir, west Tibet.

[^2]Stewart 20403 (GH) ; from Hushe to Sospor, Schlagintweit 6006 (G-type of var. schlagintweitii).

Kashmir: Ladakh: Mulbekh, Rabila, Koelz 6155, 6129a (MICH); Marsho, Koelz 6385 (MICH); Lamayuru, 3800 m., Osmaston 143 (к); Ladakh, Thomson s.n. (GH, BM, K-as Omphalodes no. 6).

Brand (l. c., 1921) recognized the plants with much longer pedicels (Schlagintweit 1006) as var. schlagintweitii. The length of fruiting pedicels is quite variable and the specimen cited above represents the variation with the longest pedicel. This has also been mentioned by Clarke (l. c., 1883) in the original description of $P$. tibeticum as "lower pedicels in fruit occasionally $1 / 4$ in."
6. M. bungei (Boiss.) Rech. f. \& H. Riedl in Køie \& Rechinger, Biol. Skr. 13(4): 209. 1963; Riedl in Rechinger, Fl. Iranica 48: 121. 1967.

Echinospermum bungei Boiss. Fl. Orient. 4: 252. 1875.
Paracaryum bornmülleri Brand, Repert. Sp. Nov. 14: 149. 1915.
Paracaryum bungei (Boiss.) Brand, Pflanzenr. IV. 252 (Heft 78): 47. 1921; M. Pop. in FI. URSS 19: 605. 1953.

Type: Persia borealis, prope Shahrud (28 Maio 1868), Bunge s.n. (Gholotype, GH-isotype).

Icon.: Riedl, l. c. fig. 167, 168. 1963, under M. tibeticum; M. Pop. 1. c. t. 29. fig. 3. 1953, under Paracaryum bungei.

Annual, erect, ascending or sometimes prostrate herb. Stems solitary to few, to 25 cm . long, usually branched near the base, branches long; stem and branches covered on the lower part with spreading, on the upper part with antrorsely appressed to subappressed, white trichomes to 1 mm . long, arising from prominent tuberculate bases. Basal leaves $1-2$, narrowly oblong to narrowly lanceolate, obtuse, short petiolate, $10-15 \mathrm{~mm}$. Iong and $1.5-2 \mathrm{~mm}$. broad; lower cauline leaves lanceolate to subspathulate, subsessile or very short petiolate, obtuse to acutish at apex, narrowed towards the base, $10-13(-18) \mathrm{mm}$. long, $2-3(-6) \mathrm{mm}$. broad, covered on both surfaces with short, thin, white trichomes arising from tuberculate bases; upper cauline leaves shorter and narrower. Inflorescence lax, much elongated in fruit. Pedicels hairy, lacking in flower, elongated to 6 mm . in fruit. Calyx divided to the base, lobes lanceolate, hairy, ca. 1.5 mm . long in flower, $2-3 \mathrm{~mm}$. long in fruit. Corolla blue, to 2 mm . long, tubularcampanulate, tube equalling the sepals, limb short, lobes subpatent; faucal appendages broader than long, emarginate. Nutlets ovoid, up to 4 mm . long, up to 3 mm . broad, winged at the margins, wings narrow, slightly curved at the edges, dentate, teeth glochidiate at the apex, dorsal middle area vertically appendiculate, appendages glochidiate at apex. Style to 0.5 mm . long.

Distribution: Iran, Afghanistan, West Pakistan, Pamir Alaj, Kizil Kum.

West Pakistan: Kalat Dist.: Basima, between Panjgur and Surab, 1350 m . Kazmi s.n. (PEs) ; Rechinger 28281 (w); between Surab and Kalat, 10 kms. from Kalat, Lamond 681 (e); Shalku, Jafri \& Akbar 2936 (e). Makran Dist.: between Panjgur and Surab, near Nag, 1300 m., Kazmi 1258 (GH, PEs); Rechinger 28260 (w); Panjgur, Irrigation Scheme, sandy river bed below Dams, $1000 \mathrm{~m} .$, Kazmi $1208 b$ (Pes) ; Lamond 604 (e). Quetta Dist.: between Padag and Nushki, 1200 m., Lamond 169 (e); Rechinger 27335 (w). Zнов Dist.: Fort Sandeman to Wana, 26 km . from Fort Sandeman, between Zhob and Sambaza, 1500 m., Kazmi 1920a (Pes); Lamond 1755 (E); Rechinger 29844a (w). Reported from: Chagai, 60 km . E. Dalbundin, ad radices M. Rus Kuh, Rechinger 27296 (w).

The characters, which differentiate Mattiastrum bungei from its very closely related species $M$. tibeticum, are the marginal wings of the nutlets curved along the side in $M$. bungei, those of $M$. tibeticum being flat. The margins of the wings in both species are dentate, but the teeth are blunt and do not bear glochidia at the apex in $M$. tibeticum, whereas in $M$. bungei the teeth are slightly produced and do bear glochidia at the apex. The plants of $M$. tibeticum are stouter and erect as compared to the weak stems, and branches of M. bungei. The former usually have many basal leaves, the latter have only one or two.

Brand (l. c. 1921) and Riedl (l. c. 1963 \& 1967) do not mention the length of the pedicels of M. bungei. In the isotype (Shahrud, Bunge (GH)) the pedicels of the lower fruits are as long as 15 mm ., a condition I did not find in the specimens cited above, only a few of them having pedicels to 6 mm . in length.

## 23. Solenanthus Ledeb. Icon. Pl. Fl. Rossica $t .26 .1829$; Fl. Alt. 1: 193. 1829.

## Type species: Solenanthus circinnatus Ledeb.

Perennial or biennial, villous or tomentose herbs. Leaves alternate. Inflorescence terminal or axillary, short thyrsoid, later usually elongated into loose panicles, ebracteate. Flowers pedicellate, pedicels short, later elongated. Calyx divided to the base, lobes hairy, scarcely enlarged in fruit. Corolla cylindrical to funnelform; faucal appendages present. Stamens much exserted from the corolla; anthers subglobose to ovoid. Nutlets ovoid to subglobose, appendiculate at the margins, on the dorsal face or all around, appendages glochidiate, coherent to free from the style.

Species 10 to 14 , distributed in southern Europe, central and southwest Asia.

## Key to the Species

a. Basal leaves truncate to cordate at the base, abruptly narrowed into the petioles; cauline leaves semiamplexicaul; anthers ca. 0.5 mm . long.

1. S. circinnatus.
a. Basal leaves neither truncate nor cordate at the base, gradually narrowed into the petioles; cauline leaves sessile; anthers ca. 1 mm . long. .2. S. stamineus.
2. S. circinnatus Ledeb. Fl. Alt. 1: 194. 1829, Icon. Pl. Fl. Rossica t. 26. 1829; DC. Prodr. 10: 164. 1846; Boiss. Fl. Orient. 4: 270. 1875 ; C. B. Clarke in Hook. f. Fl. Brit. India 4: 160. 1883; Aitch. Bot. Afgh. Delim. Comm. 88. 1888; Brand, Pflanzenr. IV. 252 (Heft 78) : 157. 1921; M. Pop. in Fl. URSS 19: 642. 1953; Riedl in Rechinger, Fl. Iranica 48: 131. 1967.

Solenanthus amplifolius Boiss. Diagn. Pl. Orient. 11: 126. 1849; Fl. Orient. 4: 270. 1879.
S. rumicifolius Boiss. Dec. Pl. Nov. Orient. 2: 9. 1875.
S. stamineus (Desf.) Wettst. var. cuneatifolius Bornm. Beih. Bot. Centralbl. 20b: 193. 1906.

Type: In regionibus orientalibus ad fl. Irtysch. C. A. Meyer s.n. (Le).
Icon.: Ledeb. Icon. Pl. Fl. Rossica t. 26. 1829; M. Pop. 1. c. t. 37. 1953; Riedl, 1. c. t. 46. fig. 1. 1967.

Perennial, erect herb, $30-120 \mathrm{~cm}$. tall. Stem simple, striate, fistulous, covered loosely to densely with soft, crisped white trichomes. Basal leaves, petiolate, (including petioles) $10-60 \mathrm{~cm}$. long, (2-) $5-10(-14) \mathrm{cm}$. broad, elliptic-oblong to oblong-lanceolate, obtuse to acutish, at the base usually cordate, sometimes truncate, loosely or densely pubescent on both surfaces, on the lower surface sometimes with some scattered trichomes arising from minute tuberculate bases, upper surfaces rarely glabrous; cauline leaves much reduced in size, usually sessile, cordate at the base, semiamplexicaul, loosely or densely pubescent on both surfaces. Inflorescence congested, capitate in young plants, later thyrsoid or rarely loose paniculate, ebracteate. Pedicels short. Calyx densely pubescent, divided to the base, lobes oblong-ovate to oblong-lanceolate, obtuse to subacute, $3-5 \mathrm{~mm}$. long in flower, not much enlarged in fruit. Corolla blue, $4.5-6 \mathrm{~mm}$. long, cylindric-infundibuliform, lobes triangular, subacute, erect, ca. 1 mm . long; faucal appendages oblong, developed below the middle of the corolla tube. Anthers ovate, 0.5 mm . long; filaments at the base not at all to conspicuously dilated, ca. 5 mm . long, much exserted from the corolla. Nutlets ovoid, obtuse, $6-7 \mathrm{~mm}$. long, dorsally irregularly appendiculate, appendages glochidiate.

Distribution: Iraq, Iran, Afghanistan, West Pakistan, Kashmir; Caucasus, Turkestan, Pamir Alaj, Siberia, Tien Shan, Dsungaro-Tarbagatai.

West Pakistan: Chitral State: Rumbur, Bowes Lyon 663 (bM, e); Ziarat, Lowari Pass, 2600 m., Stainton 2339 (BM); Agram, Arkari Gol, west Tirichmir, 3150 m., Stainton 2634 (BM, E) ; Shigar Arirat, 2850 m., Bowes Lyon 758 (BM). Reported from: Chitral, Barum Gol, Shokor Shal, 3500 m., Wendelbo s.n.

Kashmir: Ladak: Dras, 3500 m ., Ludlow \& Sherriff 8319 (GH); Zanskar, Herb. Ind. Or. Hook. f. \& Thoms., Thomson s.n. (GH). Reported from: Pangee, Watt s.n.; Ladakh in Chilungtal, Meebold 4242.
2. S. stamineus (Desf.) Wettst. Denkschr. Akad. Wiss. Wien 50 (2) : 88. 1885; Brand, Pflanzenr. IV. 252 (Heft 78) : 155. 1921; M. Pop.
in Fl. URSS 19: 652. 1953; Riedl in Rechinger, Fl. Iranica 48 : 133. 1967.

> Cynoglossum stamineum Desf. Ann. Mus. Hist. Nat. Paris 10: 431.1807.
> Mattia staminea Roem. \& Schult. Syst. Veg. 4: 82 \& 764. 1819.
> Moltkia libanotica Zucc. Abh. Acad. Wiss. München 3: 246. 1837-1843.
> Solenanthus tournefortii DC. Prodr. 10: 164. 1846.
> Solenanthus conglobatus DC. Ibid. 166.
> Solenanthus strictissimus Brand, Repert. Sp. Nov. 13: 546. 1915; Pflanzenr. IV. 252 (Heft 78): 156. 1921; Riedl in Rechinger, Fl. Iranica 48: 133. 1967, syn. nov.

Type: Cappadocia, Tournefort s.n. (p).
Icon.: Brand, l. c. fig. 21. 1921.
Perennial, erect herb, to 70 cm . tall. Stem simple, striate, fistulous, covered loosely or densely with soft, patent or retrorsely subappressed white trichomes. Basal leaves petiolate, (including petioles) to 45 cm . long and $3.5(-6) \mathrm{cm}$. broad, lanceolate to oblong-lanceolate, acute to subacute, at the base narrowed into a long petiole, 3 -5-nerved, nerves prominent below and covered on the upper surface loosely, on the lower surface densely with short, crisped, white trichomes, the nerves with dense, subappressed trichomes; middle cauline leaves sessile, shorter and narrower; upper cauline leaves shorter and broader. Inflorescence terminal or in the axils of the upper leaves, congested in short, cylindrical thyrses when young, later elongated, ebracteate. Pedicels lacking in flower, up to 2 mm . long in fruit. Calyx divided to the base, lobes $2-4(-5) \mathrm{mm}$. long, ca. 1 mm . broad, oblong-lanceolate, obtuse, erect, pubescent. Corolla dark red to rarely yellowish, $5-6(-7) \mathrm{mm}$. long, cylindrical, lobes 0.5 mm . long, 1 mm . broad at the base, triangular to broad-ovate, erect; faucal appendages subquadrate, emarginate, developed at the middle of the corolla tube. Filaments up to 5 mm . long, slightly dilated at the base, inserted at the middle of the corolla tube; anthers 1 mm . long, ovate, much exserted from the corolla. Nutlets ca. 10 mm . long, ovoid, at the margins densely, and at the dorsal middle area sparsely appendiculate, appendages glochidiate at apex.

Distribution: Greece, Turkey, Syria, Lebanon, Iraq, Iran, Caucasus, Afghanistan, West Pakistan, Pamir Alaj.

West Pakistan: Chitral State: Serer, 3300 m., Bowes Lyon 791 (bM, e); Agram, Arkari Gol, west of Tirichmir, 3330 m., Stainton 2627 (bM). Hazara Dist.: Kagan Valley, Kamalban forests, Kazmi s.n. (pes); Kagan Valley, Narang, 3. 6. 1927, Champion s.n. (GH). Gilgit Agency: Plants of Gilgit Expedition (Solenanthus $=5980$ Griffith, Kew Distrib.), Giles s.n. $($ e-type of S. strictissimus).

Brand (1. c. 1915, 1921) distinguishes Solenanthus strictissimus from S. stamineus by its linear, basal leaves to 10 cm . long and by its corolla and calyx lobes 1 mm . shorter. The primary basal leaves in S. stamineus are also linear and short, they dry and fall away as soon as the secondary
basal leaves appear. The secondary basal leaves, which are found on most collections are much longer and broader than the primary leaves. Solenanthus strictissimus is based on the only collection of Giles from Gilgit Agency and no other collection of this species has been made since. It appears that one of the early leaves, which is shorter and narrower, left attached to the type collection, led Brand to recognize it as a distinct species. As there are no differences in the form and indument of the cauline leaves and the structure and measurements of the floral parts, I consider S. strictissimus to be a synonym of $S$. stamineus.
[To be continued]


[^0]:    * Continued from volume 51, p. 520.

[^1]:    ${ }^{2}$ I am naming this species in honor of Professor Richard A. Howard, Director of the Arnold Arboretum of Harvard University.

[^2]:    West Pakistan: Gilgit Agency: Baltistan, Indus River Valley, 10 miles east of Skardu, 2600 m., Webster \& Nasir 5857 (GH) ; Skardu, 2600 m., R. R.

